

CLAIMS

What is claimed is:

1. A composition comprising a triarylmethane having Formula I,  
 5 shown in Figure 1, wherein:  
 $Ar^1$  can be the same or different at each occurrence and is selected from aryl and heteroaryl;  
 $R^1$  is the same or different at each occurrence and is selected from H, alkyl, heteroalkyl, aryl, heteroaryl, arylalkylene,  
 10 heteroarylalkylene,  $C_nH_aF_b$ , and  $C_6H_cF_d$ , or adjacent  $R^1$  groups can be joined to form 5- or 6-membered rings;  
 $X$  can be the same or different at each occurrence and is selected from  $R^1$ , alkenyl, alkynyl,  $N(R^1)_2$ ,  $OR^1$ ,  $OC_nH_aF_b$ ,  $OC_6H_cF_d$ , CN,  $COOR^1$ , halide,  $NO_2$ , and OH;  
 15  $n$  is an integer from 1 through 12, and  
 $a$ ,  $b$ ,  $c$ , and  $d$  are 0 or an integer, such that  $a+b = 2n + 1$ , and  $c + d = 5$ ,  
 with the proviso that there is at least one substituent on an aromatic group selected from F,  $C_nH_aF_b$ ,  $OC_nH_aF_b$ ,  $C_6H_cF_d$ , and  
 20  $OC_6H_cF_d$ .
2. The composition of Claim 1, wherein the triarylmethane is selected from Formulae I(f), I(k), I(m), I(n), and I(p) in Figure 3.
3. A composition selected from Formulae I(i), I(j), I(l), I(o), and I(q), I(r), I(s) and I(t) in Figure 3.
- 25 4. A composition having at least two triarylmethane carbons, said composition having Formula II in Figure 2, wherein:  
 $Ar^1$  is the same or different at each occurrence and is selected from aryl and heteroaryl;  
 $R^1$  is the same or different at each occurrence and is selected from  
 30 H, alkyl, heteroalkyl, aryl, heteroaryl, arylalkylene, heteroarylalkylene,  $C_nH_aF_b$ , and  $C_6H_cF_d$ ;  
 $R^2$  is the same or different at each occurrence and is selected from arylene, heteroarylene, arylenealkylene, and heteroarylenealkylene, with the proviso that when  $R^2$  is  
 35 arylenealkylene or heteroarylenealkylene, an arylene end is attached to the triarylmethane carbon;  
 $Q$  is selected from a single bond and a multivalent group;  
 $m$  is an integer equal to at least 2; and

p is 0 or 1, with the proviso that when p is 0, Q is a multivalent group that is arylene or heteroarylene.

5. The composition of Claim 4 wherein Q is selected from a hydrocarbon group with at least two points of attachment, selected from an aliphatic group, a heteroaliphatic group, an aromatic group, and a heteroaromatic group.

6. The composition of Claim 5 wherein Q is selected from alkylene groups, heteroalkylene groups, alkenylene groups, heteroalkenylene groups, alkynylene groups, and heteroalkynylene groups.

7. The composition of Claim 4 wherein Q is selected from single-ring aromatic groups, multiple-ring aromatic groups, fused-ring aromatic groups, single-ring heteroaromatic groups, multiple-ring aromatic groups, fused-ring aromatic groups, arylamines, silanes and siloxanes.

8. The composition of Claim 4 wherein Q is selected from Formulae III(a) through III(h) in Figure 4.

9. The composition of Claim 4 wherein  $Ar^1$  is selected from phenyl, substituted phenyl, biphenyl, and substituted biphenyl.

10. The composition of Claim 9 wherein  $Ar^1$  is selected from substituted phenyl and substituted biphenyl having at least one substituent selected from alkyl, heteroalkyl, aryl, heteroaryl, arylalkylene, heteroarylalkylene,  $C_nH_aF_b$ , and  $C_6H_cF_d$ , where

a, b, c, and d are 0 or an integer, such that  $a+b = 2n + 1$ , and  $c + d = 5$ , and

n is an integer.

11. The composition of Claim 4 wherein  $Ar^1$  is selected from phenyl, substituted phenyl, biphenyl, and substituted biphenyl, wherein at least one carbon atom is replaced with a heteroatom.

12. The composition of Claim 4 wherein  $R^2$  is selected from phenyl, substituted phenyl, biphenyl, substituted biphenyl, pyridyl, substituted pyridyl, bipyridyl, and substituted bipyridyl.

13. The composition of Claim 12 wherein  $R^2$  is selected from substituted phenyl, substituted biphenyl, substituted pyridyl, having at least one substituent selected from , heteroalkyl, aryl, heteroaryl, arylalkylene, heteroarylalkylene,  $C_nH_aF_b$ , and  $C_6H_cF_d$ , where

a, b, c, and d are 0 or an integer, such that  $a+b = 2n + 1$ , and  $c + d = 5$ , and

n is an integer.

14. The composition of Claim 4 selected from Formulae II(a) through II(h) in Figure 5.

15. An electronic device comprising at least one layer comprising a triarylmethane derivative having Formula I, shown in Figure 1, wherein:

5         $Ar^1$  can be the same or different at each occurrence and is selected from aryl and heteroaryl;

$R^1$  is the same or different at each occurrence and is selected from H, alkyl, heteroalkyl, aryl, heteroaryl, arylalkylene, heteroarylalkylene, arylalkylene, heteroarylalkylene,  $C_nH_aF_b$ ,  
10        and  $C_6H_cF_d$ , or adjacent  $R^1$  groups can be joined to form 5- or 6-membered rings;

         X can be the same or different at each occurrence and is selected from  $R^1$ , alkenyl, alkynyl,  $N(R^1)_2$ ,  $OR^1$ ,  $OC_nH_aF_b$ ,  $OC_6H_cF_d$ , CN,  $COOR^1$ , halide,  $NO_2$ , and OH;

15        n is an integer from 1 through 12, and

         a, b, c, and d are 0 or an integer, such that  $a+b = 2n + 1$ , and  $c + d = 5$ ,

         with the proviso that when  $X_5Ar^1$  is p-methylphenylene,  $R^1$  is not ethyl.

20        16. The electronic device of Claim 15, wherein  $Ar^1$  is selected from phenyl, substituted phenyl, biphenyl, and substituted biphenyl.

         17. The device of Claim 16 wherein  $Ar^1$  is selected from substituted phenyl and substituted biphenyl having at least one substituent selected from alkyl, heteroalkyl, aryl, heteroaryl, arylalkylene,  
25        heteroarylalkylene,  $C_nH_aF_b$ , and  $C_6H_cF_d$ , where

         a, b, c, and d are 0 or an integer, such that  $a+b = 2n + 1$ , and  $c + d = 5$ , and

         n is an integer.

30        18. The device of Claim 15 wherein  $Ar^1$  is selected from phenyl, substituted phenyl, biphenyl, and substituted biphenyl, wherein at least one carbon atom is replaced with a heteroatom.

         19. The device of Claim 15 wherein  $X_5Ar^1$  has an  $Ar^1$  selected from phenyl, substituted phenyl, biphenyl, substituted biphenyl, pyridyl, substituted pyridyl, bipyridyl, and substituted bipyridyl.

35        20. The device of Claim 19 wherein  $Ar^1$  is selected from substituted phenyl, substituted biphenyl, substituted pyridyl, having at least one substituent selected from , heteroalkyl, aryl, heteroaryl, arylalkylene, heteroarylalkylene,  $C_nH_aF_b$ , and  $C_6H_cF_d$ , where

a, b, c, and d are 0 or an integer, such that  $a+b = 2n + 1$ , and  $c + d = 5$ , and  
n is an integer.

21. The device of Claim 15, wherein at least one substituent on an  
5 aryl ring selected from F,  $C_nH_aF_b$ ,  $OC_nH_aF_b$ ,  $C_6H_cF_d$ , and  $OC_6H_cF_d$ ,  
where

a, b, c, and d are 0 or an integer, such that  $a+b = 2n + 1$ , and  $c + d = 5$ , and  
n is an integer.

10 22. The device of Claim 15, wherein at least one X group is  
selected from F,  $C_nH_aF_b$ ,  $OC_nH_aF_b$ ,  $C_6H_cF_d$ , and  $OC_6H_cF_d$ , where  
a, b, c, and d are 0 or an integer, such that  $a+b = 2n + 1$ , and  $c + d = 5$ , and  
n is an integer.

15 23. The electronic device of Claim 15, wherein the triarylmethane  
derivative is selected from Formulae I(a) through I(t) in Figure 3.

24. An electronic device comprising at least one layer comprising a  
charge transport composition having at least two triarylmethane carbons,  
said composition having Formula II in Figure 2, wherein:

20  $Ar^1$  can be the same or different at each occurrence and is selected  
from aryl and heteroaryl;

$R^1$  is the same or different at each occurrence and is selected from  
H, alkyl, heteroalkyl, aryl, heteroaryl, arylalkylene,  
heteroarylalkylene,  $C_nH_aF_b$ , and  $C_6H_cF_d$ ;

25  $R^2$  is the same or different at each occurrence and is selected from  
arylene, heteroarylene, arylenealkylene, and  
heteroarylenealkylene, with the proviso that when  $R^2$  is  
arylenealkylene or heteroarylenealkylene, an arylene end is  
attached to the triarylmethane carbon;

30 Q is selected from a single bond and a multivalent group;

m is an integer equal to at least 2; and

p is 0 or 1, with the proviso that when p is 0, Q is a multivalent  
group that is arylene or heteroarylene.

25. The device of Claim 24 wherein Q is selected from a  
35 hydrocarbon group with at least two points of attachment, selected from an  
aliphatic group, a heteroaliphatic group, an aromatic group, and a  
heteroaromatic group.

26. The device of Claim 25 wherein Q is selected from alkyl groups, heteroalkyl groups, alkenyl groups, heteroalkenyl groups, alkynyl groups, and heteroalkynyl groups.

27. The device of Claim 24 wherein Q is selected from single-ring aromatic groups, multiple-ring aromatic groups, fused-ring aromatic groups, single-ring heteroaromatic groups, multiple-ring aromatic groups, fused-ring aromatic groups, arylamines, silanes and siloxanes.

28. The device of Claim 24, wherein Q is selected from Formulae III(a) through III(h) in Figure 4.

29. The device of Claim 24 wherein Ar<sup>1</sup> is selected from phenyl, substituted phenyl, biphenyl, and substituted biphenyl.

30. The device of Claim 29 wherein Ar<sup>1</sup> is selected from substituted phenyl and substituted biphenyl having at least one substituent selected from alkyl, heteroalkyl, aryl, heteroaryl, arylalkylene, heteroarylalkylene, C<sub>n</sub>H<sub>a</sub>F<sub>b</sub>, and C<sub>6</sub>H<sub>c</sub>F<sub>d</sub>, where

a, b, c, and d are 0 or an integer, such that  $a+b = 2n + 1$ , and  $c + d = 5$ , and

n is an integer.

31. The device of Claim 24 wherein Ar<sup>1</sup> is selected from phenyl, substituted phenyl, biphenyl, and substituted biphenyl, wherein at least one carbon atom is replaced with a heteroatom.

32. The device of Claim 24 wherein R<sup>2</sup> is selected from phenyl, substituted phenyl, biphenyl, substituted biphenyl, pyridyl, substituted pyridyl, bipyridyl, and substituted bipyridyl.

33. The device of Claim 32 wherein R<sup>2</sup> is selected from substituted phenyl, substituted biphenyl, and substituted pyridyl, having at least one substituent selected from, heteroalkyl, aryl, heteroaryl, arylalkylene, heteroarylalkylene, C<sub>n</sub>H<sub>a</sub>F<sub>b</sub>, and C<sub>6</sub>H<sub>c</sub>F<sub>d</sub>, where

a, b, c, and d are 0 or an integer, such that  $a+b = 2n + 1$ , and  $c + d = 5$ , and

n is an integer.

34. The device of Claim 24, wherein the charge transport composition is selected from Formula II(a) through Formula II(h) in Figure 5.

35. The composition of Claim 4, wherein at least one N(R<sup>1</sup>)<sub>2</sub> is a fused aromatic ring group.

36. The composition of Claim 4, wherein at least one N(R<sup>1</sup>)<sub>2</sub> is selected from carbazoles, benzodiazoles, and benzotriazoles.

37. The device of Claim 36, wherein at least one X is a fused heteroaromatic ring group.

38. The device of Claim 37, wherein at least one X is selected from N-carbazoles, benzodiazoles, and benzotriazoles.

5        39. The device of Claim 24, wherein at least one  $N(R^1)_2$  is a fused heteroaromatic ring group.

40. The device of Claim 39, wherein at least one  $N(R^1)_2$  is selected from carbazoles, benzodiazoles, and benzotriazoles.

10       41. A composition comprising a triarylmethane having Formula I, shown in Figure 1, wherein:

Ar<sup>1</sup> can be the same or different at each occurrence and is selected from aryl and heteroaryl;

R<sup>1</sup> is the same or different at each occurrence and is selected from H, alkyl, heteroalkyl, aryl, heteroaryl,  $C_nH_aF_b$ , and  $C_6H_cF_d$ ,

15       n is an integer from 1 through 12, and

a, b, c, and d are integers such that  $a+b = 2n + 1$ , and  $c + d = 5$ , with the proviso that there is at least one substituent on an aromatic group selected from F,  $C_nH_aF_b$ ,  $OC_nH_aF_b$ ,  $C_6H_cF_d$ , and  $OC_6H_cF_d$ .

20       42. The composition of Claim 41, wherein the triarylmethane is selected from Formulae I(a) through I(p) in Figure 3.

43. A composition selected from Formula II in Figure 2, wherein:

Q is selected from a single bond and a multivalent group;

m is an integer from 2 through 10;

25       Ar<sup>1</sup> can be the same or different at each occurrence and is selected from aryl and heteroaryl;

R<sup>1</sup> is the same or different at each occurrence and is selected from H, alkyl, heteroalkyl, aryl, heteroaryl,  $C_nH_aF_b$ , and  $C_6H_cF_d$ .

30       44. The composition of Claim 43 wherein Q is selected from Formulae III(a) through III(h) in Figure 4.

45. The composition of Claim 43 selected from Formula II(a), Formula II(b), and Formula II(c) in Figure 5.

46. An electronic device comprising at least one layer comprising the charge transport composition of any one of Claims 41 through 45.

35       47. An electronic device of Claims 41 through 45, wherein the device is a light-emitting diode, light-emitting electrochemical cell, or a photodetector.